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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
|-----------------|-------------|----------------------|---------------------|------------------|

10/799,739

03/15/2004

Tomohiko Yamamoto

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05/17/2007

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EXAMINER

SLOMSKI, REBECCA

ART UNIT

PAPER NUMBER

2877

MAIL DATE

DELIVERY MODE

05/17/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/799,739             | YAMAMOTO, TOMOHIKO  |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Rebecca C. Slomski     | 2877                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 12 February 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>2/21/07</u> | 6) <input type="checkbox"/> Other: _____  |

DETAILED ACTION

*Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 3, 11 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "pivotal characteristic" is undefined in the claims or the specification. For the purposes of this office action, the examiner has taken "pivotal characteristic" to mean any noticeable characteristic in the resist pattern.

*Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1-6 and 9-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Masayuki in JP Publication 11-307431.

2. With respect to claim 1, Masayuki discloses a method of exposing a semiconductor device comprising:

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- Preliminarily forming, by transfer, at least two types of test resist patterns  
(Abstract, Drawing 6 and Drawing 7)
  - Which differ from each other in the pattern density of said transfer target  
(Drawing 6 and Drawing 7)
  - Calculating a focal variation of said transfer target using said individual test resist patterns (Abstract)
3. With respect to claim 2, Masayuki discloses the limitations as applied to claim 1 above. In addition, Masayuki discloses:
- Test resist patterns include a first test resist pattern having a larger pattern density and a second test resist pattern having a smaller pattern density (Claim 2, Drawing 6 and Drawing 7)
  - Measuring a first shape value of said first test resist pattern, calculating a proper exposure energy based on said first shape value, measuring second shape value of said second test resist pattern, and calculating a focal variation of said transfer target based on said second test resist pattern and calculating a focal variation of said transfer target based on said second shape value and said proper exposure energy (Claim 1)
4. With respect to claim 10, Masayuki discloses manufacturing a semiconductor device comprising:

- A size measuring instrument for measuring a first shape value of said first test resist pattern having a larger pattern density (Claim 1 and Claim 2)
  - An exposure energy variation calculating unit for calculating exposure energy variation based on said measured first shape value (Claim 1)
  - A size measuring unit for measuring a second shape value of said second test resist pattern having a pattern density smaller than said first test resist pattern -(Claim 1 and Claim 2)
  - Focal variation calculating unit for calculating focal variation of said transfer target based on said measured second shape value and said exposure energy variation (Claim 1)
5. With respect to claims 3 and 11, Masayuki discloses the limitations as applied to claims 1, 2 and 10 above. In addition, Masayuki discloses:
- The first test resist pattern shows a pivotal characteristic and said second test resist pattern shows no pivotal characteristic (P.0016)
6. With respect to claim 4 and 12, Masayuki discloses the limitations as applied to claims 1, 2 and 10 above. In addition, Masayuki discloses:
- Shape value is at least one of width, height, and taper angle (Abstract)
7. With respect to claim 5, Masayuki discloses the limitations as applied to claims 1 and 2 above. In addition, Masayuki discloses:

- The calculation of said proper exposure energy said first shape value is measured and then said proper exposure energy is determined using a first data base which expresses relations between said first shape value and said proper exposure energy (Claim 5)

8. With respect to claim 6, Masayuki discloses the limitations as applied to claims 1 and 2 above. In addition, Masayuki discloses:

- The calculation of said focal variation said second shape value is measured, and then said focal variation is determined using a second data base which expresses relations of said proper exposure energy and said second shape value with said focal variation (Claim 4 and Claim 5)

9. With respect to claim 9, Masayuki discloses the limitations as applied to claim 1 above. In addition, Masayuki discloses:

- The pattern is transferred under a proper amount of focusing said amount of focusing being obtained based on said calculated focal variation and being fed back to said individual transfer targets or to a product lot comprising a plurality of said transfer targets (Abstract)

10. With respect to claim 13, Masayuki discloses the limitations as applied to claim 10 above.

In addition, Masayuki discloses:

- Exposure energy variation calculating unit determines proper exposure energy by using a first data base which expresses relations between said first shape value and said proper exposure energy (Claim 5)

11. With respect to claim 14, Masayuki discloses the limitations as applied to claim 10 above.

In addition, Masayuki discloses:

- Focal variation calculating unit determines said focal variation using a second data base which expresses relations of said proper exposure energy and said second shape value with said focal variation (Claim 4 and Claim 5)

*Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7, 8, 15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Masayuki in JP Publication 11-307431 in view of Nishi JP Patent #62-160723.

12. With respect to claim 7, Masayuki discloses the limitations as applied to claim 1 above. In addition, Masayuki discloses:

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- Said individual test resist patterns are formed by transfer, together with resist pattern, by stacking at least one process target film and a resist film on said transfer target and then subjecting said resist film to light exposure (P.0020)
- Focal variation is calculated using results of measurement of optical constants preliminarily made on at least either one of said process target film and said resist film (P.0022 and P.0026)

However, Masayuki fails to disclose the focal variation is calculated using the results of film thickness preliminarily made on at least either one of said process target film and said resist film.

Nishi discloses an alignment apparatus comprising:

- Focal variation is calculated using results of measurement of film thickness preliminarily made on at least either one of said process target film and said resist film (Constitution)

It would have been obvious to one of ordinary skill in the art at the time the invention was conceived to use the film thickness measurement of Nishi for the focal variation calculation of Masayuki since considering the film thickness would increase alignment accuracy. (Nishi, Constitution)

13. With respect to claim 15, Masayuki discloses the limitations as applied to claim 10 above.

In addition, Masayuki discloses:



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- Said individual test resist patterns are formed by transfer, together with resist pattern, by stacking at least one process target film and a resist film on said transfer target and then subjecting said resist film to light exposure (P.0020)
- Measuring unit for measuring optical constants which preliminarily measures said optical constants of at least either one of said process target film and said resist film, results of said measuring being used for calculating said focal variation (P.0022 and P.0026)

However, Masayuki fails to disclose the measuring unit for measuring film thickness of at least one of said process target film and said resist film used for calculating said focal variation.

Nishi discloses an alignment apparatus comprising:

- Measuring unit for measuring film thickness which preliminarily measures said film thickness of at least either one of said process target film and said resist film, results of said measuring being used for calculating said focal variation (Constitution)

It would have been obvious to one of ordinary skill in the art at the time the invention was conceived to use the film thickness measurement of Nishi for the focal variation calculation of Masayuki since considering the film thickness would increase alignment accuracy. (Nishi, Constitution)

14. With respect to claims 8 and 16, Masayuki in view of Nishi discloses all of the limitations as applied to claims 1, 7, 10, and 15 above. However, Masayuki is silent as to measuring the optical constants and film thickness of the entire stacked film having all of the individual process target films and said resist film formed therein by stacking.

It would have been obvious to one of ordinary skill in the art at the time the invention was conceived to measuring the optical constants and film thickness of the entire stacked film having all of the target films and resist films stacked thereon since the measurement of all the films together would increase accuracy of the focal variation for that point in which all the films are stacked.

Claims 17-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masayuki in JP Publication 11-307431 in view of Ausschnitt et al. U. S. Patent #6,027,842.

15. With respect to claim 17, Masayuki discloses a method of manufacturing a semiconductor device comprising:

- A first step of forming a process target film on a semiconductor substrate (P.0016)
- A second step of forming a resist film on said process target film (P.0016)
- A third step of forming, by pattern transfer to said resist film, at least two types of test resist patterns differed from each other in the pattern density together with a resist pattern (P.0016, Drawing 6 and Drawing 7)

- A fourth step of calculating a focal variation of said process target film using said individual test resist patterns (P.0017)
- A fifth step of judging whether said calculated focal variation falls within a specified range or not (P.0029)

However, Masayuki fails to disclose the process advances to the next step if said focal variation was judged as being within the specified range, whereas said resist pattern and said test resist patterns are removed and said second through fifth steps are repeated if judged as being out of the specified range.

Ausschnitt et al. discloses a process for controlling etching parameters comprising:

- The process advances to the next step if said focal variation was judged as being within the specified range, whereas said resist pattern and said test resist patterns are removed and said second through fifth steps are repeated if judged as being out of the specified range. (Figure 19)

It would have been obvious to one of ordinary skill in the art at the time the invention was conceived to advance to the next step if the focal variation was judged within a specified range and repeat the measurement process if it isn't as in Ausschnitt et al. since this would choose only the proper patterns to be printed, encouraging efficiency in manufacturing and accuracy in production.

16. With respect to claim 18, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claim 17 above. In addition, Masayuki discloses:

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- Test resist patterns include a first test resist pattern having a larger pattern density and a second test resist pattern having a smaller pattern density (Claim 2, Drawing 6 and Drawing 7)
- Measuring a first shape value of said first test resist pattern, calculating a proper exposure energy based on said first shape value, measuring second shape value of said second test resist pattern, and calculating a focal variation of said transfer target based on said second test resist pattern and calculating a focal variation of said transfer target based on said second shape value and said proper exposure energy (Claim 1)

17. With respect to claim 19, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claims 17 and 18 above. In addition, Masayuki discloses:

- The first test resist pattern shows a pivotal characteristic and said second test resist pattern shows no pivotal characteristic (P.0016)

18. With respect to claim 20, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claims 17 and 18 above. In addition, Masayuki discloses:

- Shape value is at least one of width, height, and taper angle (Abstract)

19. With respect to claim 21, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claims 17 and 18 above. In addition, Masayuki discloses:

- The calculation of said proper exposure energy said first shape value is measured and then said proper exposure energy is determined using a first data base which expresses relations between said first shape value and said proper exposure energy (Claim 5)

20. With respect to claim 22, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claims 17 and 18 above. In addition, Masayuki discloses:

- The calculation of said focal variation said second shape value is measured, and then said focal variation is determined using a second data base which expresses relations of said proper exposure energy and said second shape value with said focal variation (Claim 4 and Claim 5)

21. With respect to claim 25, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claim 17 above. In addition, Masayuki discloses:

- The pattern is transferred under a proper amount of focusing said amount of focusing being obtained based on said calculated focal variation and being fed back to said individual transfer targets or to a product lot comprising a plurality of said transfer targets (Abstract)

Claims 23 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masayuki in JP Publication 11-307431 in view of Ausschnitt et al. U. S. Patent #6,027,842 and further in view of Nishi JP Patent # 62-160723.

22. With respect to claim 23, Masayuki in view of Ausschnitt et al. discloses the limitations as applied to claim 17 above. In addition, Masayuki discloses:

- Optical constants of at least either one of said process target film and said resist film are preliminarily measured and results of the measurement are used for calculating said focal variation (P.0022 and P.0026)

However, Masayuki fails to disclose film thickness is preliminarily measured and used for calculating focal variation.

Nishi discloses:

- Film thickness of at least either one of said process target film and said resist film are preliminarily measured and results of the measurement are used for calculating said focal variation (Constitution)

It would have been obvious to one of ordinary skill in the art at the time the invention was conceived to use the film thickness measurement of Nishi for the focal variation calculation of Masayuki since considering the film thickness would increase alignment accuracy. (Nishi, Constitution)

23. With respect to claim 24, Masayuki in view of Ausschnitt et al. and further in view of Nishi discloses all of the limitations as applied to claims 17 and 23 above. However, Masayuki is silent as to measuring the optical constants and film thickness of the entire stacked film having all of the individual process target films and said resist film formed therein by stacking.

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It would have been obvious to one of ordinary skill in the art at the time the invention was conceived to measure the optical constants and film thickness of the entire stacked film having all of the target films and resist films stacked thereon since the measurement of all the films together would increase accuracy of the focal variation for that point in which all the films are stacked.

#### *Citation*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Fujisawa et al. U. S. Publication #2004/0058256 discloses a dose monitoring method of a semiconductor device.
- Starikov et al. U. S. Patent #7,006,208 discloses a defect compensation for lithography.
- Ausschnitt et al. U. S. Patent #6,879,400 discloses a metrology target method for lithography with various spaced arrays.

#### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rebecca C. Slomski whose telephone number is 571-272-

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9787. The examiner can normally be reached on Monday through Thursday, 7:30 am - 5:00 pm EST.

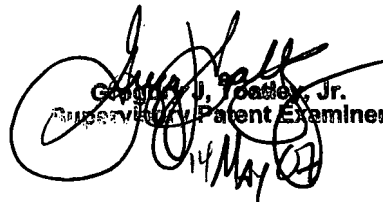
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on 571-272-2059. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rebecca C. Slomski  
Assistant Patent Examiner

rsc



Gregory J. Toatley, Jr.  
Assistant Patent Examiner  
14 May 07